CLAIMS

1. A method of manufacturing a thin film comprising:

a low temperature highly doped layer growing step of performing dopant doping while growing the thin film at a given first temperature;

an annealing step of interrupting the growth of the thin film and annealing the thin film at a given second temperature higher than said first temperature; and

a high temperature lowly doped layer growing step of growing the thin film at said second temperature.

2. The method according to Claim 1, wherein a given number of said low temperature highly doped layer growing step, said annealing step and said high temperature lowly doped layer growing step are repeated.

3. A method of manufacturing a thin film comprising:

a low temperature highly doped layer growing step of performing dopant doping while growing the thin film at a given first temperature; and

an annealing step of interrupting the growth of the thin film and annealing the thin film at a given second temperature higher than said first temperature.

4. The method according to Claim 3, wherein a given number of said low temperature highly doped layer growing step and said annealing step are repeated.

5. The method according to any one of Claims 1 to 4, wherein a heat-treatment from said first temperature to said second temperature is performed by radiation of a laser beam.

6.A method of manufacturing a p-type zinc oxide thin film comprising:

a low temperature highly doped layer growing step of performing nitrogen doping while growing the zinc oxide thin film at a given first temperature;

an annealing step of interrupting the growth of the zinc oxide thin film and annealing the zinc oxide thin film at a given second temperature higher than said first temperature; and

a high temperature lowly doped layer growing step of growing the zinc oxide thin film at said second temperature.

7. The method according to Claim 6, wherein a given number of said low temperature highly doped layer growing step, said annealing step and said high

8. The method according to Claim 6 or 7, wherein said first temperature is about 300 °C and said second temperature is about 800 °C.

9. The method according to any one of Claims 6 to 8, wherein a heat-treatment from said first temperature to said second temperature is performed by radiation of a laser beam.

10. A semiconductor device comprising the p-type zinc oxide thin film manufactured by the method according to any one of Claims 6 to 8.

11. The semiconductor device according to Claim 10, said device is a light emitting device.

12. A semiconductor element comprising:

a substrate consisting of a material with a lattice constant highly matching that of zinc oxide; a buffer layer of a zinc oxide thin film to which annealed zinc oxide or magnesium oxide is added; and a zinc oxide thin film layer deposited on said buffer layer.

13. The semiconductor element according to Claim 12, wherein said material comprises any of $ScAlMgO_4$, $ScAlZnO_4$, $ScAlCoO_4$, $ScAlMnO_4$, $ScGaZnO_4$, $ScGaMgO_4$, $ScAlZn_3O_6$, $ScAlZn_4O_7$, $ScAlZn_7O_{10}$, $ScGaZn_3O_6$, $ScGaZn_5O_8$, $ScGaZn_7O_{10}$, $ScFeZn_2O_5$, $ScFeZn_3O_6$ or $ScFeZn_6O_9$.

14. The semiconductor element according to Claim 12 or 13, further comprising a insulating layer using a material with the same basic structure as that of said substrate.

15. The semiconductor element according to Claim 12, 13 or 14, further comprising a luminescent layer using a material with the same composition or structure as that of said zinc oxide thin film layer as a base, said luminescent layer being provided on said zinc oxide thin film layer; and a channel semiconductor layer using a material with the same composition or structure as that of said zinc oxide thin film layer as a base, said channel semiconductor layer being provided on said luminescent layer and being different from said zinc oxide thin film layer.

16. The semiconductor element according to Claim 15, wherein said luminescent layer is any of a multi-layer structure of (Mg, Zn)O and ZnO, a multi-layer structure of (Zn, Cd) O and ZnO, or a multi-layer structure of (Mg,

17. A method of manufacturing a semiconductor element comprising steps of:

forming a substrate from a material with a lattice constant highly matching that of zinc oxide;

forming a buffer layer of a zinc oxide layer on said substrate, zinc oxide or magnesium oxide being added to said buffer layer;

annealing said buffer layer;

forming a zinc oxide thin film layer on said annealed buffer layer.

18. The method according to Claim 17, wherein said material comprises any of $ScAlMgO_4$, $ScAlZnO_4$, $ScAlCoO_4$, $ScAlMnO_4$, $ScGaZnO_4$, $ScGaMgO_4$, $ScAlZn_3O_6$, $ScAlZn_4O_7$, $ScAlZn_7O_{10}$, $ScGaZn_3O_6$, $ScGaZn_5O_8$, $ScGaZn_7O_{10}$, $ScFeZn_2O_5$, $ScFeZn_3O_6$ or $ScFeZn_6O_9$.

19. The method according to Claim 17 or 18, wherein said buffer layer is annealed at about not less than 1000 °C during said step of annealing said buffer layer.

20. The method of Claim 17, 18 or 19, wherein said step of annealing said buffer layer is performed in an electric furnace or a deposition apparatus.